PROGRESS REPORT OF THE PARTIES
NUTRIENTS ANNEX CHAPTER

OVERVIEW

Excessive nutrients entering the Great Lakes are one of the primary causes of the development of algal blooms, which can be harmful to human health and the environment. Of the five Great Lakes, Lake Erie is most impacted by toxic and nuisance algae due to its shallowness and surrounding land use.

Algal bloom image

Through the Nutrients Annex of the 2012 GLWQA, Canada and the United States commit to coordinating binational actions to manage phosphorus concentrations and loadings in the Waters of the Great Lakes. From 2014 to 2016, implementation activities have focused on establishing new binational phosphorus reduction targets for Lake Erie while working with others to manage phosphorus concentrations and loadings in Lake Erie as a means of reducing excessive algal growth.

State of the Lakes: Trends in harmful and nuisance algae are worsening in nearshore areas and are impacting human and ecosystem health. Increasing water clarity is accelerating the proliferation of nuisance algae along some shorelines and signifies a lack of food for fish offshore. Low oxygen levels in the central Lake Erie basin are causing seasonal "dead zones" for aquatic life. [To be updated w/ SOGL 2016 info]

ACTIONS TAKEN TO MEET KEY COMMITMENTS

Priorities for Science and Action were established to focus implementation efforts on key commitments from the 2012 GLWQA's Nutrients Annex during the first three years (Table x).

Table x – Binational Priorities for Science and Action and Key Commitments		
NATIONAL PRIORITIES FOR SCIENCE	• Undertake science to support the establishment of phosphorus concentration objectives, loading targets and loading allocations. • Identify sources of phosphorus and priority watersheds for action. • Improve understanding of how aquatic invasive species, lake dynamics, climate change and other factors affect phosphorus concentrations and algae growth. • Improve monitoring techniques and approaches to enable tracking progress towards objectives.	**KEY COMMITMENTS** • By 2016, develop binational substance objectives for phosphorus concentrations, loading targets, and loading allocations for Lake Erie. • By 2018, develop binational phosphorus reduction strategies and domestic action plans to meet the objectives for phosphorus concentrations and loading targets in Lake Erie. • Assess, develop, and implement programs to reduce phosphorus loadings from urban, rural, industrial and agricultural sources. This will include proven best management practices, along with new approaches and technologies. • Identify priority watersheds that contribute significantly to local algae development, and develop and implement management plans to achieve phosphorus load reduction targets and controls. • Undertake and share research, monitoring and modeling necessary to establish, report on and assess the management of phosphorus and other nutrients and improve the understanding of relevant issues associated with nutrients and excessive algal blooms.
BINATIONAL PRIORITIES FOR ACTION	• By 2016, update the 1987 offshore phosphorus concentration objectives for Lake Erie and develop new nearshore phosphorus concentration objectives. • By 2016, determine the phosphorus loading targets for Lake Erie, apportioned by country, required to achieve the above phosphorus objectives. • Assess the effectiveness of current programs and practices to manage phosphorus inputs to Lake Erie. • By 2018 Develop and implement phosphorus reduction strategies and domestic action plans to ensure measures to manage phosphorus produce maximum results.	

Binational Actions Taken

The primary action taken in support of these commitments was the establishment of revised binational

phosphorus loading targets for Lake Erie. In the first three years, Canada and the United States worked collaboratively with provincial and state governments, local watershed management agencies and universitieso conduct a comprehensive science-based assessment of the phosphorus reductions needed to meet Lake Ecosystem Objectives for Lake Erie, and reach consensus on new phosphorus limits for the Lake. Canada and the United States agreed that significant reductions in phosphorus are needed to combat Western basin algal blooms and Central basin hypoxia –low oxygen zones.. Specifically, Canada and the United States agreed to reduce phosphorus loading to the Western and Central basins by forty percent. A new target load of 6,000 metric tons of phosphorus annually to the Central Basin was also established and each country agreed to reduce their load by forty percent from 2008 levels to achieve the target load. To this end, Canada and the United States will reduce their loads by 212 metric tons and 3316 metric tons, respectively.

This load is expected to reduce the extent of the hypoxic zone and raise the dissolved oxygen levels in the bottom waters of the Central basin to 2 mg/L. Canada and the United States also identified eight priority watersheds – two in Canada and six in the United States -- for phosphorus control to address algal blooms occurring in the nearshore waters of Lake Erie. Finally, because the modeling showed that spring loading of phosphorus from the Maumee River in Ohio is the determining factor in the production of cyanobacteria in the Western basin, specific seasonal targets were identified for the Maumee River. A forty percent reduction Maumee spring phosphorus loads is expected to lower cyanobacteria biomass in the Western basin to mild levels in 9 years out of 10.

In the summer of 2015, Canada and the United States held engagement sessions on the recommended binational phosphorus load reduction targets to combat Lake Erie algal blooms. These engagement sessions included a fact sheet and technical report posted on www.binational.net, www.nutrientsbinational.net, and http://www2.epa.gov/glwqa/recommended-binational-phosphorus-targets to solicit public comments, as well as webinars or in-person meetings with specific interest groups – the agricultural sector;local watershed management agencies; environmental groups; municipalities; First Nation and Metis representatives, and special interest groups.

The revised phosphorus targets, summarized in Table x, were ratified by Canada and the United States in February 2016 following consideration ofcomments received during the consultation period. These targets address all but one of the Lake Ecosystem Objectives identified in the Agreement. More work is needed to address the second Lake Ecosystem Objective, "Maintain the levels of algae below the level constituting a nuisance condition," which is of particular importance in the Eastern basin of Lake Erie, and in other parts of the Great Lakes. While models were used to explore the impact of phosphorus reduction on nuisance algae (*Cladophora*) growth in the Eastern basin, the confidence in the model predictions is not adequate to recommend a specific target at this time. Additional research is required to link phosphorus loadings to changes in algal production prior to recommending phosphorus reduction targets to address *Cladophora*.

Table x - Binational Phosphorus Load Reduction Targets

Lake Ecosystem Objectives *(as outlined in Annex 4 Section B of the 2012 GLWQA)*	**Western Basin of Lake Erie**	**Central Basin of Lake Erie**
Minimize the extent of hypoxic zones in the Waters of the Great Lakes associated with	40 percent reduction from 2008 levels in total phosphorus entering the Western Basin and Central Basin of Lake Erie –	

excessive phosphorus loading, with particular emphasis on Lake Erie	from the United States and from Canada – to achieve 6000 MT Central Basin load. This amounts to a reduction of 3316 metric tons and 212 metric tons from the United States and Canada, respectively	
Maintain algal species consistent with healthy aquatic ecosystems in the nearshore Waters of the Great Lakes	40 percent reduction in spring total and soluble reactive phosphorus loads from the following watersheds where localized algae is a problem:	
	Thames River - Canada Maumee River - U.S. River Raisin - U.S. Portage River - U.S. Toussaint Creek - U.S. Leamington Tributaries - Canada	Sandusky River - U.S. Huron River, OH - U.S.
Maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health in the Waters of the Great Lakes	40 percent reduction in spring total and soluble reactive phosphorus loads from the Maumee River (U.S.)	N/A

While in general there was strong public support for these targets, stakeholders expressed concerns with the lack of a phosphorus target to address nuisance Cladophora in the Eastern basin of Lake Erie. Canada and the United States are committed to taking the actions required to establish a target for the Eastern basin, including continuing supporting research, monitoring and modeling efforts that will improve our scientific understanding of *Cladophora* growth and propose further phosphorus reductions to ameliorate nuisance algae impacts in the Eastern basin, if warranted. Recent actions toward this goal include:

- Binational workshop on the state of the science of Cladophora in early 2016. The results of this workshop …
- Environment Canada research expected to wrap up march 2016
- The US and Canada formed a new workgroup with representatives from EPA, EC, NYSDEC, OMOEE, OMNRF, and USGS to initiate nutrient target development in Lake Ontario. The group will start by examining current trends and data gaps particularly with respect to nearshore Cladophora growth as a response to nutrient levels in Lake Ontario.

Binational strategy {expected draft in Feb 2016}

Canada and the United States prepared a binational strategy for implementation of the Lake Erie phosphorus reductions moving forward. The strategy identifies binational priorities for research and monitoring, with a focus on coordinating our efforts to track progress through an active adaptive management process.

Finally, Canada and the United States have begun work to develop domestic action plans.These plans will outline in more detail the specific implementation strategies needed to achieve the 40% reductions.

In addition to binational actions taken by Canada and the United States, each country has taken numerous domestic actions in support of the key commitments of the Nutrients Annex. Table x and Table x briefly outline some examples of these domestic actions.

Table x – Domestic Canadian Actions Taken	
Environment Canada's Great Lakes Nutrient Initiative	Through the **Great Lakes Nutrient Initiative**, Canada undertook new science in support of the development of the binational phosphorus reduction targets and development of the phosphorus reduction strategies and action plans. This new science included monitoring to determine the contribution of phosphorus to Lake Erie from Canadian sources, research to understand the factors contributing to excessive algae development in the lake, and modeling to predict the levels of phosphorus reductions required to reduce or eliminate the excessive algae development problem. As one of the key elements of the Initiative, Environment Canada is leading an evaluation of policy options and best practices for reducing phosphorus discharges from both non-point and point sources to support decision making by all levels of government and the private sector for the control of toxic and nuisance algae levels in the Great Lakes. Through the *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, 2014*, Environment Canada is engaging other federal departments, Ontario ministries, municipalities, the private sector, non-government organizations, and the public to identify and assess existing policies and practices that contribute to excess phosphorus entering Lake Erie, and the effectiveness of current controls. This effort is being supplemented by identification of best practices internationally for phosphorus management, including an assessment of relative costs and benefits, an analysis of information requirements to inform policy decision making, and policy options for reducing phosphorus loadings to Lake Erie.
Environment Canada's Lake Simcoe/ South-eastern Georgian Bay Clean Up Fund	Through the Lake Simcoe / South-eastern Georgian Bay Clean-up Fund, Environment Canada is supporting community-based projects that demonstrate on-the-ground actions to reduce phosphorus discharges from urban and rural sources, protect and create aquatic habitat, and enhance research and monitoring for decision making. Together these Funds have leveraged $51.2 million and supported 186 projects *[revise to include only those projects related to nutrients over the 3yrs?]* by provincial and municipal governments, Conservation Authorities, academia, First Nations, and non-governmental organizations and citizens. A complete list of these projects is available at www.ec.gc.ca/lakesimcoe_georgianbay.
Agriculture and Agri-Food Canada programs, including Growing Forward 2	Through **Growing Forward 2**, Agriculture and Agri-Food Canada collaborates with the province of Ontario on a cost-shared basis to work with producers to assess the environmental risks and benefits on their farm, provide them with tools to identify practices, and develop an action plan that can reduce environmental risks on their farm. These practices include soil nutrient testing, minimizing nutrient applications, and planting buffer strips along waterways, supporting the reduction of the loss of nutrients into the Great

	Lakes and its tributaries. As part of Growing Forward 2, governments of Canada and Ontario are supporting farmers through cost-shared funding of the **Great Lakes Agricultural Stewardship Initiative** (GLASI). The key components of GLASI are improving soil health, water quality and promoting environmental stewardship in the Lake Erie basin and the southeast shores of Lake Huron. AAFC also undertakes scientific research to investigate strategies to manage nitrogen, phosphorus, and manure in pursuit of improved agricultural practices to reduce nutrient losses.
Health Canada's Microcystin Guidelines	Health Canada is working to finalize its guideline and technical document on cyanobacterial toxins, scheduled to be posted for public consultations in winter 2015-2016. The proposed updated guideline will maintain a maximum acceptable concentration (MAC) of 1.5 µg/L for the general population, as a seasonal value. As a precaution, it will also recommend that drinking water authorities advise residents to use an alternate source of drinking water, like bottled water, when preparing infant formula during an algal bloom or when microcystins are detected in drinking water. Health Canada and the U.S. EPA have collaborated for the last 3 years on an assessment of cyanobacterial toxins in drinking water, providing the basis for establishing drinking water limits for both countries.
Provincial / State Initiatives	The province of Ontario is working collaboratively with U.S. Great Lakes States to address harmful algal blooms in Lake Erie. In June 2015, the province signed the Western Basin of Lake Erie Collaborative Agreement with Michigan and Ohio, committing to reducing phosphorus loadings to Lake Erie's western basin by 40% over the next 10 years (including an interim reduction goal of 20% by 2020). The three partners agreed to establishing implementation plans to direct early actions and serve as an interim approach to the domestic action plans being established under the GLWQA 2012 The province of Ontario also joined with the Lake Erie U.S. States to form the Lake Erie Nutrient Targets (LENT) Working Group (www.glc.org/projects/water-quality/lent/) to develop new and refine existing practices, programs and policies to achieve pollutant reduction targets and/or identify additional remedies to improve water quality in Lake Erie.
Watershed Management Plans	Through the Grand River Watershed Management Plan (www.grandriver.ca/wmp), municipalities, provincial and federal agencies and First Nations are undertaking voluntary actions and best practices to improve stormwater management, to optimize waste water treatment plants and to share lessons learned. Work continues to develop nutrient source area maps using digital elevation models that pinpoint erosion-prone areas for better placement of BMPs. Collectively, these actions will help reduce phosphorus loads to the eastern basin of Lake Erie.

	A Water Management Plan is also being developed for the Thames River (www.thamesrevival.webnode.com/watermanagementplan), a main source of nutrients from Ontario to Lake St. Clair and the Lake Erie basin. The plan is anticipated to reduce flood damage potential, ensure sustainable water supplies, and improve water quality. Current work includes: BMP demonstration projects to reduce nutrient runoff; water quality assessment to determine nutrient sources and loads within the watershed; a Low Impact Design program to address urban non-point source runoff; and work to update flood frequency statistics, automate digital elevation models, and reliably estimate spatially-distributed precipitation. The MOECC, Environment Canada, local community foundations and other partners funded many of these Conservation Authority initiatives.

Table x – Domestic U.S. Actions Taken	
	[start of domestic action plans]
	[domestic program efforts to address nutrients]